

ACAULESCENT GROWTH FORMS OF *STRELITZIA*: HYBRIDIZATION AND CHROMOSOME NUMBERS

J. G. C. SMALL, H. A. VAN DE VENTER AND CORNELIA J. GARNER

(Department of Botany, University of Port Elizabeth)

ABSTRACT

Successful hybridization between *S. reginae* Ait. and *S. juncea* Link was achieved. F_1 plants had intermediate lamina forms. The somatic chromosome complement for parent and F_1 plants was found to be $2n = 14$.

It is speculated that the natural variation in acaulescent growth forms is ecoclinal. Although the junceous form may warrant taxonomic recognition on the basis of its occurrence in pure stands, this study supports the view that the epithet *parvifolia* be abandoned.

UITTREKSEL

ONGESTINGELDE GROEIVORMS VAN *STRELITZIA*: KRUISING EN CHROMOSOOM GETALLE

Suksesvolle kruisings is tussen *S. reginae* Ait. en *S. juncea* Link gemaak. F_1 plante het intermediêre blaarskyfvorms getoon. Die somatiese chromosoom getal vir beide ouers en F_1 plante is gevind $2n = 14$ te wees.

Daar word gespekuleer dat die natuurlike variasie in blaarvorm wat by die akoulesie groeivorms aangetref word ekoklinaal is. Alhoewel die juncea-vorm, weens die voorkoms daarvan in groot suiwer stande, moontlik spesifieke taksonomiese erkenning behoort te geniet, ondersteun hierdie studie die mening dat van die epiteton *parvifolia* afgesien moet word.

INTRODUCTION

The genus *Strelitzia* is represented by both caulescent and acaulescent growth forms. Although taxonomists apparently agree on recognizing three caulescent species (*S. nicolai* Regel and Koern, *S. alba* (L.f.) Skeels, *S. caudata* R. A. Dyer) conflicting views on the taxonomic treatment of the acaulescent growth forms have been put forward.

In *Flora Capensis*, Wright (1913) describes two acaulescent species: *S. reginae* and *S. parvifolia*. Moore and Hyypio (1970) suggest that only one species (*S. reginae*) be recognized. Van de Venter, Small & Robbertse (1975) support the suggestion of doing away with the epithet *parvifolia* but together with Dyer (1975) favour the recognition of two species (*S. reginae* Ait. and *S. juncea* Link). *S. reginae* would then include all forms possessing a distinct lamina whereas *S. juncea* would represent the form in which the mature plant either lacks a leaf blade altogether or possesses extremely reduced leaf blades.

A resolution of this problem would require more information. The present report describes a successful *S. reginae* $\times$ *S. juncea* hybridization experiment and provides data from a cytological investigation.

MATERIAL AND METHODS

Hybridization

S. juncea plants (in cultivation, Port Elizabeth) were hand pollinated with *S. reginae* pollen (ex Settler's Park, Port Elizabeth) on September 20, 1974 and inflorescences marked. Only hand-pollinated flowers produced fruits. These were harvested during March 1975.

S. reginae, *S. juncea* and hybrid seeds were soaked in 4 000 ppm ethrel (Industrial Chemical Products) to break dormancy (Van de Venter and Small, 1975; Van de Venter, 1978) and planted in commercial potting soil contained in 360 mm diameter polythene pots. Seedlings were later thinned to one per pot. In addition to regular watering with tap water, plants received half strength Hoaglands nutrient solution once a week.

During the first year of growth, plants were kept in a growth cabinet (day/night temperature 25/20 °C, 14 h photoperiod) after which they were placed outdoors in full sunlight.

Leaf formation was followed and measurements made on 26 hybrid plants and six each of *S. reginae* and *S. juncea* plants during the period April 1975 to December 1978.

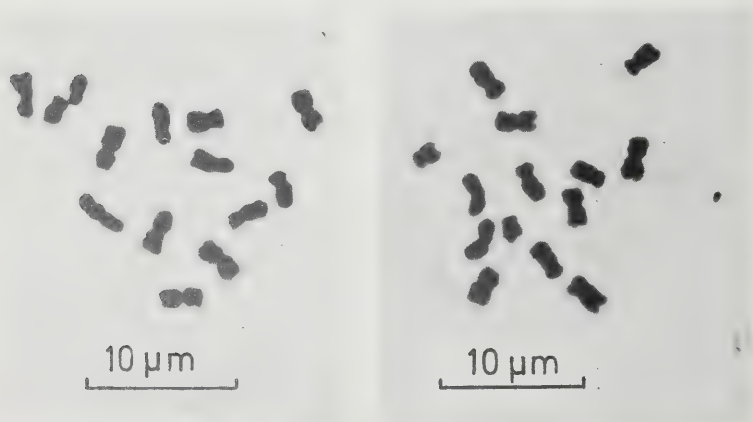


FIG. 1
Somatic chromosomes of (a) *S. reginae* and (b) *S. juncea*

Cytology

Somatic chromosomes were observed in developing anthers of hybrid plants, *S. reginae* and *S. juncea*. Root apices were also examined in the case of the latter two species.

Due to initial difficulties in obtaining good chromosome preparations, a number of fixing and staining techniques were tested. The following procedure gave good results and was followed in this study.

Commencing at 11h00 plant material was pretreated in 4 mM 8-hydroxyquinoline solution for 4 h at 16 °C followed by a 10 min rinse in running tap water. Fixation occurred in an ethanol : acetic acid (3:1) mixture for 1 h at 16 °C. Material was then macerated in ethanol : HCl (2:1) for 16 min at room temperature and then rinsed four times at 15 min intervals with 70 % ethanol.

Appropriate pieces of tissue were stained directly on a microscope slide with an aceto-iron-haematoxylin chloral hydrate stain (Wittmann, 1965), squashed, slightly heated and observed in a Carl Zeiss photomicroscope.

RESULTS

Hybridization

Seed obtained from cross-pollinated flowers produced plants which exhibit a distinctly intermediate lamina form between *S. reginae* and *S. juncea*. This was shown clearly by two year old plants (Fig. 1) and is also evident from leaf measurements (Table 1). Note that the differences in leaf measurements between the three groups of plants become increasingly conspicuous as plants become more mature, i.e. with increasing leaf number. It is interesting to note that at this stage of development (leaf 18), petioles of hybrid plants were actually longer than those of either parent plant.

From these results it appears that successful hybridization between *S. reginae* and *S. juncea* was achieved and that the F_1 plants exhibited a reasonably uniform, intermediate lamina form.

TABLE 1

Leaf measurements at various stages of plant development (mm $\pm$ standard deviation)

Leaf No.	Plant type	Lamina length	Lamina width	Petiole length
1.	<i>S. reginae</i>	66 $\pm$ 8	32 $\pm$ 3	42 $\pm$ 5
	Hybrids	62 $\pm$ 11	34 $\pm$ 6	44 $\pm$ 9
	<i>S. juncea</i>	55 $\pm$ 12	27 $\pm$ 5	36 $\pm$ 8
9.	<i>S. reginae</i>	146 $\pm$ 24	79 $\pm$ 9	149 $\pm$ 39
	Hybrids	125 $\pm$ 22	77 $\pm$ 14	205 $\pm$ 64
	<i>S. juncea</i>	98 $\pm$ 7	39 $\pm$ 5	181 $\pm$ 48
18.	<i>S. reginae</i>	281 $\pm$ 36	129 $\pm$ 5	446 $\pm$ 63
	Hybrids	168 $\pm$ 39	87 $\pm$ 19	649 $\pm$ 180
	<i>S. juncea</i>	25 $\pm$ 4	5 $\pm$ 1	536 $\pm$ 140

Chromosomes

Based on a large number of observations the diploid chromosome number for *S. reginae*, *S. juncea* and their hybrid was found to be 14. Morphologically the chromosomes of the three plant groups appeared very similar. Metaphase somatic chromosomes of *S. reginae* and *S. juncea* are shown in Fig. 2.

DISCUSSION

Chromosome numbers in the Strelitziaceae have been published for *S. nicolai* ($2n = 14$), *S. alba* = *S. augusta* ($2n = 22$) and *S. reginae* ($2n = 14$) (Darlington & Wylie, 1955).

The present investigation confirms the $2n = 14$ number for *S. reginae*. It was very interesting to find that *S. juncea* has a somatic chromosome complement equal to that of *S. reginae*. Morphologically the chromosomes of these two species appeared very similar. Further detailed studies would, however, be required to establish similarities or differences in chromosome morphology.

The hybrids in this study resemble some of the intermediate growth forms encountered in the wild at Vensterhoek. Van de Venter *et al.* (1975) postulate that the Vensterhoek plants represent a *S. reginae* $\times$ *S. juncea* hybrid population. The present results support this idea. More information is hoped to be gathered from continued crossing studies with our hybrids which have now entered their second flowering cycle.



FIG. 2

Hybrid plant (middle) obtained from crossing *S. reginae* ♂ (left) with *S. juncea* ♀ (right)

The fact that the two extreme acaulescent *Strelitzia* forms hybridize to produce offspring with intermediate lamina forms argues strongly against retaining lamina size as a distinguishing character to delimit acaulescent *Strelitzia* species. It is tempting to speculate that the natural variation encountered is ecocline (Heslop-Harrison, 1964).

Although the rather extensive, pure stands of the juncaceous form at Uitenhage and Port Elizabeth areas may warrant some taxonomic rank for this form, the results of this investigation adds weight to the view of Moore and Hyypio (1970) that only one acaulescent *Strelitzia* species should be recognized. In particular this study has confirmed that the concept of a species with an intermediate sized lamina (*S. parvifolia*) is unacceptable and that this epithet should be abandoned.

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